UNITED STATES DEPARTMENT OF INTERIOR GEOLOGICAL SURVEY

EASTERN GAS SHALES PROJECT (EGSP) DATA FILES: A FINAL REPORT

by

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INTRODUCTION

The United States Geological Survey and Petroleum Information Corporation (PI) of Denver have created two large computerized files of data for the Eastern Gas Shales Project (EGSP) as part of a larger responsibility to the Department of Energy (DOE), Morgantown Energy Technology Center (METC), in Morgantown, West Virginia. Computer-compatible well, outcrop, and sample data from EGSP contractors are being stored on digital tape and delivered to METC for subsequent data-base management.

Two separate digital files have been designed. Well and outcrop data were formatted in a manner similar to data in Petroleum Information Corporation's Well History Control System (WHCS). WHCS is an oil and gas well data file containing geological, production test, and reservoir engineering data on more than 1 million wells in the United States. Detailed reservoir and production-test data were obtained from all EGSP cored wells, and stratigraphic data were obtained from a selection of key wells and outcrops throughout the entire Appalachian basin.

At present, data for more than 5,800 wells and outcrops are stored in the EGSP well-data file. More detailed reservoir and test information from Devonian shales for 53 EGSP cored wells is also stored in this file. Sample data were obtained in card-image formats developed for EGSP, and fall into three categories: (1) geochemical, (2) physical character, and (3) lithology. The EGSP sample data file contains more than 50,000 fixed-length records of information on cored wells, other special wells, and outcrops throughout the the Appalachian basin. Locality information, and the American Petroleum Institute (API) unique well-identification number permit matching wells in both files (American Petroleum Institute, 1970). Both files have been converted to a data-base format by METC for data retrieval and output.

This report has been written to: (1) discuss data-file background and development, (2) address specific problems and solutions for future project use, and (3) present a general summary of well- and sample-data file content by State, County, well, contractor, and subject coverage. This report has been prepared as part of the U.S. Geological Survey responsibility to the U.S. Department of Energy under contract E(49-18)-2287.

WELL-DATA FILE DESIGN AND SUMMARY

The U.S. Geological Survey has purchased the WHCS file and is under contract to Petroleum Information Corporation to: (1) receive completion data for new WHCS wells, and (2) receive digitally processed data as maps and printouts by request.

At present, the WHCS file contains data for approximately 1,300,000 wells in the United States, and about 93,000 of these are distributed throughout the Appalachian basin. Table 1 lists EGSP well-data file counts by State. The WHCS file has 7 basic categories of data, each of which is identified by 5-character line numbers (table 2). The WHCS file for the Appalachian basin does not have data for many of the wells for which detailed information is needed for EGSP. In general the file is not complete. The WHCS formats were therefore expanded for the EGSP well-data file to include special EGSP formation tops and bases, radioactive "hot zones" in the black shale as identified from gamma-ray logs by contractors, and additional well stimulation data (table 3). EGSP contractors responsible for building a detailed stratigraphic framework within the basin were given WHCS encoding sheets on which to encode stratigraphic production test and engineering data for both existing WHCS wells and EGSP cored wells, and selected wells for stratigraphic cross sections that are not available in WHCS.

Table 1.-- Distribution of WHCS wells by state in the Appalachian basin

State	Approximate number of WHCS wells (January 30, 1981)	EGSP wells
Ohio.....	28,341	544
Pennsylvania.....	16,391	478
West Virginia.....	21,147	514
New York.....	6,253	1,067
Kentucky.....	16,015	3,165
Virginia.....	179	33
Tennessee.....	5,142	0
Total.....	93,468	5,801
Total for Appalachian and Illinois basin.....	118,585	

Table 2.--WHCS file content by line number

Line Number	Data descriptions
10002-14000	Header information; state permits and API well number; township, range and section; well name, operator, and lease; casing, tubing, and lining; elevation, total depth, and dates.
25001-27699	Formation tops and bases by log, sample, and driller; fault information.
20001-29999 50001-59999	Initial potential and production tests (the formats for both tests are identical, but initial potential lines are preceeded by "2" and production lines are preceeded by "5"). Water rates and choke size; producing formation and interval; perforation data and treatment type; pressures and temperatures; oil, gas, and water analyses; oil gravity; shut-off intervals.
30001-39999	Core data; intervals, recovery and type of core; narrative description.
40001-49999	Drillstem and wireline test information; type of test, interval and formation; initial and final open times; flow pressures, choke sizes, and recovery; shut off intervals; mud information.
60001-69499	Miscellaneous data; log type and interval; drilling shows and porosity zones; hole deviations; on drilling information; plugging record; bit record.

The WHCS well-data file was intended to remain distinct from the EGSP well-data file and has proved to be an effective data supplement for a variety of geologic problems. Data for 50 percent of the EGSP wells are in the WHCS file.

The EGSP well-data file also contains information from outcrops. Each outcrop is reported as if it were a deviated borehole with the location of the stratigraphically youngest unit defining the actual well location and elevation. Outcrop data are stored in the file with the unique portion of the API well numbers greater than 90,001 for each county.

To transfer data most successfully in this massive encoding project, two WHCS-EGSP data-encoding workshops were held in 1977 and 1978. Representatives from each major EGSP contractor spent several hours learning how to transfer data from state files and reports to the PI-designed encoding sheets (fig. 1). In special instances, data were directly encoded by PI in Denver.

All EGSP well-data passes through a series of edit routines originally designed for use with WHCS data. Before EGSP wells are recorded on tape in final form, data for each well passes through the following edit categories:

1. Edits to determine whether a data field must be present.
2. Edits to determine whether a data field must be alphabetic or numeric.
3. Edits that compare data fields on the same line that are related to each other.
4. Edits that compare data fields not on the same line that are related to each other.

Additional special edits include (1) latitude-longitude edits to determine that the actual latitude-longitude values fall within the boundaries of the specified county, (2) valid state and abbreviations edits, (3) edits to determine whether successive strings of casing and tubing are smaller and

Table 3.--Special EGSP well data formats

25071-25099	Log tops.
25171-25199	Log bases.
25271-25299	Sample tops.
25371-25399	Sample bases.
25471-25499	Driller tops.
25571-25599	Driller bases.
7XX01-7XX09 (odd increment)	Special treatment, proping agent, amount of treatment, and interval.
7XX02-10 (even increment)	Injection rate, type of additive and amount, fluid recovery time, costs, and rig time.
7XX11-7XX15	Staging data.
7XX16-7XX20	Keil staging data.
7XX21-7XX25	Hydraulic fracturing.
7XX26-7XX31	Explosive fracturing.
7XX32-51	Propulsion system.

API CONTROL CODE (15) | INTENT CODES LCF(1.) SF(1)

GENERAL INFORMATION LINES

	ACTIVE(1)	COMPLETED(1)	SUSPENDED(1)	WC OR DEV(1)	DEEP TEST(1)	NO FIRST REPORT(1)
WRS ONLY 001						

	NEW WHCS CONTROL CODE(20)
WRS ONLY -99	

	CODE(1)	OLD API CONTROL CODE(14)	CODE(1)	OLD WHCS CONTROL CODE(20)
WRS ONLY 10000				

	OLD API CONTROL CODE(15)	NEW API CONTROL CODE(15)	MONTH(2)	YEAR(2)	P(1)
10000					

	OLD WHCS CONTROL CODE(21)	NEW WHCS CONTROL CODE(21)
10001		

	LATITUDE(8)	LONGITUDE(8)	LATITUDE(8)	LONGITUDE(8)
10002				

	SURFACE LOCATION				BOTTOM HOLE LOCATION					
	± (1)	X COORDINATE (7) (2)	± (1)	Y COORDINATE (7) (2)	± (1)	X COORDINATE (7) (2)	± (1)	Y COORDINATE (7) (2)	PROJ(1)	STATE ZONE(4)
10003										

	CNTY(3)	UNIQUE NO.(6)	PROV CODE(3)	FIELD CODE(6)	OPERATOR CODE(6)	CLASS(2)	STATUS(4)	FORM AT TD(8)	PROD FORM(8)	TD(5)	CTI DATE(3)
10010											

	2ND PROD FORM(8)	3RD PROD FORM(8)	4TH PROD FORM(8)	5TH PROD FORM(8)	6TH PROD FORM(8)	7TH PROD FORM(8)
10011						

	PERMIT NO(6)	HOLE CHANGE REFERENCE(2)	INTERNAL CONTROL NUMBER(15)	2ND PERMIT NO(6)
10013				

	BLK, LGE, TWP(3)	NUMBER(3)	SEC, LABOR, LOT(5)	NUMBER(4)	ABSTRACT NUMBER(7)
10020					

FORM NO 493 G.I.L. WRS/WHCS 6/76 10F

FIGURE 1. Sample WHCS Well-file Encoding Sheet.

deeper than previous strings, (4) edits to determine whether formation depths are less than or equal to the total depth, and (5) edits to determine whether the "field code" category is correct.

Edit routines were modified to incorporate the additional EGSP data. Errors were manually corrected by referring to the encoding sheets, source documents when available, and the appropriate EGSP contractor.

Appendix A lists the number of wells in each county for which data are available in the EGSP well file. Tape copies of both the full WHCS file[1] and the EGSP well-data file are stored at METC.

SAMPLE-DATA FILE DESIGN AND SUMMARY

Early in 1977, when the EGSP was in its early phases of development, many EGSP contractors were at different stages of project involvement. At that time, some contractors had explicitly defined their laboratory and analytical procedures, whereas other contractors were only in a preliminary design phase. At the same time, sample-data formats had to be designed, data had to be gathered, and some effort had to be made to allow for potential data retrieval. Furthermore, some contractors were provided EGSP funds for sample-data encoding, whereas others were not. Consequently, we decided to have contractors encode data whenever possible, but to accept actual data source documents as necessary, and to accept computer tapes when contractors maintained internal computerized data systems.

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[1]The WHCS file is proprietory and unapproved distribution of these data in digital form or PI proprietary format is unlawful.

Initial discussions with METC and with each EGSP contractors revealed three basic sample categories: (1) geochemical, (2) physical character, and (3) lithology. Analytical procedures and specific data categories were determined by visiting each contractor separately. Initial fixed-field formats for each contractor and sample subject area were reviewed by METC, the USGS, and PI. Before final formats were approved by METC, contractor review sessions were held to discuss data-unit problems, the actual order of data items in the file, data dependence, and analytical procedures. Opinions were varied and often conflicting. A decision was reached to include most contractor-suggested formats in the sample-data file. New data items could then be added when and if analytical methods and techniques changed. Final data-encoding sheets and instructions were prepared and distributed to each contractor (Dyman and Wilcox, unpub. data).

Data encoding was designed to include a unique sample description, a physical description, and locality for each sample for which data are stored (fig. 2). The sample description includes all information encoded on a header sheet: the state code, county code, unique well or outcrop number, project and laboratory codes, sample number, date of analysis, depths, sample type, external sample condition, and latitude and longitude coordinates. The sample number is unique and remains the same for each specific sample description, but it must change whenever any part of the sample description changes.

Whenever a sample number was encoded in columns 5-12 on a data sheet (fig. 3) for one or more of the three data categories, it was also encoded in columns 23-30 on the header sheets for the same data categories. All format sheets accommodate data or header information. Standard 80-column encoding forms were used in this project. Every format sheet or card has a 4-column card class that distinguishes it from all other cards.

PHYSICAL CHARACTERIZATION
HEADER INFORMATION

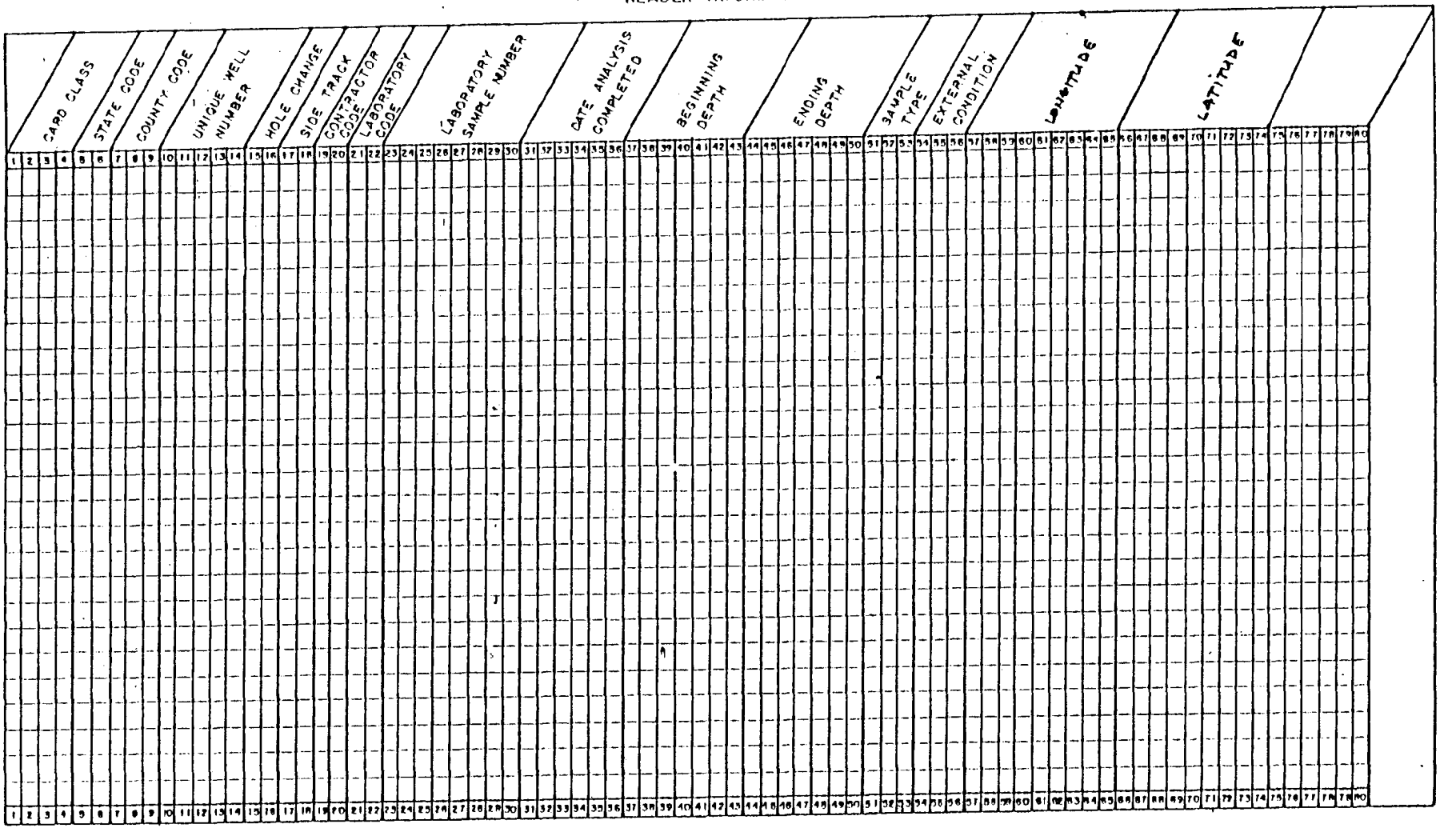

FIGURE 2. Sample-file Header Encoding Sheet.

GEOCHEMICAL FILE
VITRINITE REFLECTANCE OF ROCK

CARD 18

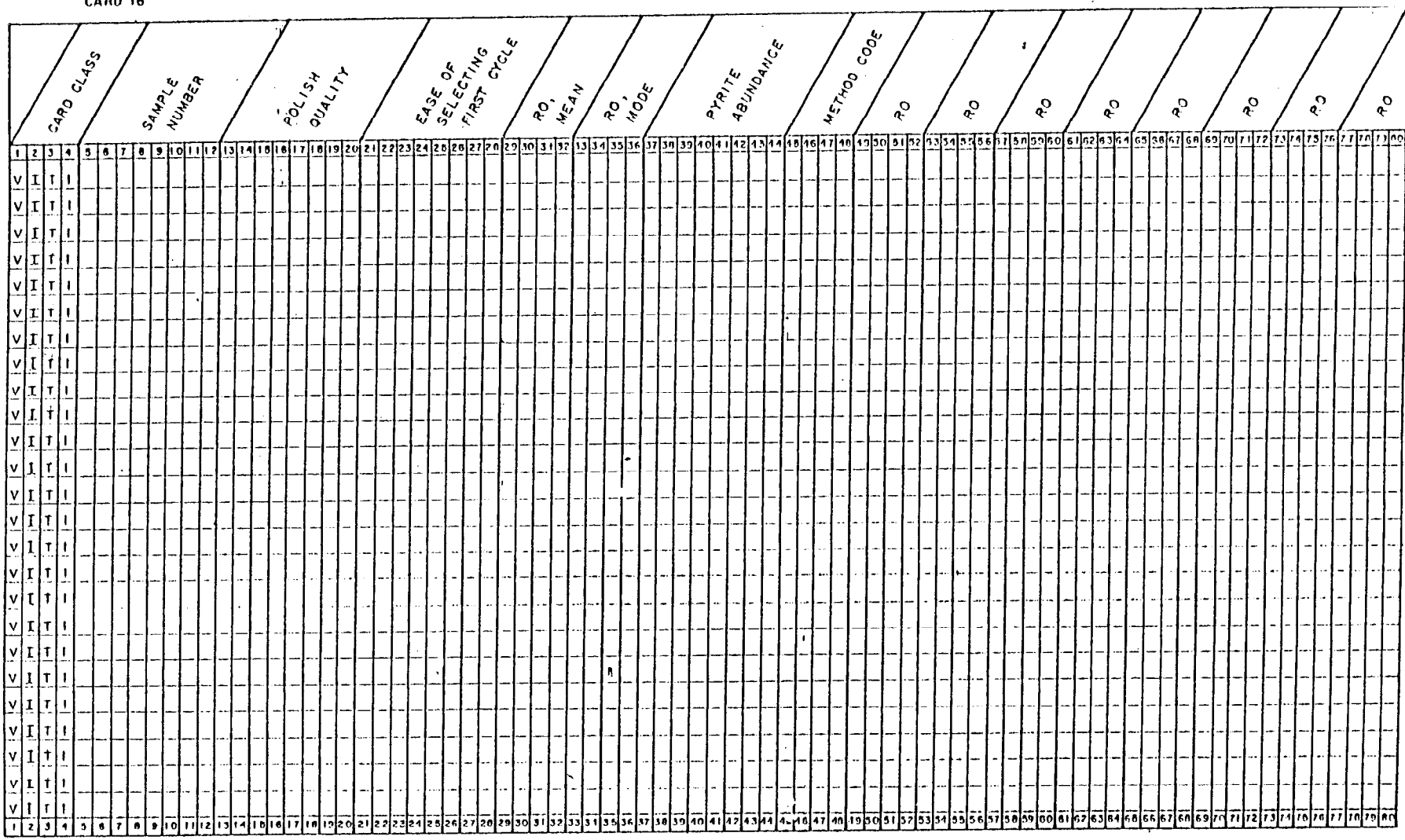

FIGURE 3. Sample-file Data Encoding Sheet.

All data-encoding formats, special encoding instructions, and project, laboratory, sample type,and external sample condition codes have been presented to METC (Dyman and Wilcox, 1979). Appendix B is a summary of card classes and data categories for each sample category.

All EGSP sample data has passed through an edit and retrieval program identified as TSPH07 to search for:

1. invalid card classes,
2. invalid sample numbers,
3. duplicate sample numbers,
4. invalid project or laboratory codes,
5. data records without corresponding header records, and
6. header records without corresponding data records.

If any of the first five errors are noted, the records are deleted from the final data file and are printed separately for manual correction. Because the EGSP sample-data file has both header and data records in different character positions, a program was written to build a reformatted input file for the edit program.

TSPH07 also creates two summary reports. In report 1, data are sequentially sorted by contractor code, sample-file type, laboratory code, card type, and card class. The report contains both header and data records in their original format for each contractor, and counts header and data records by laboratory, sample-file type, and EGSP contractor (fig. 4). The total number of sample-file records for each card class is also calculated. Report 2 data are sorted sequentially by contractor code, sample-file type, laboratory code, API unique well number, sample number, card type, and card class. The report contains data records in their original formats for well, outcrop, and sample numbers submitted by each EGSP contractor. Card class

```
CONTRACTOR: WEST VIRGINIA          FILE: LITHOLOGY     LAB: MARY BENLING          WELL NMBR: 4704321637000O   SAMPLE NMBR: 124027.3
                          WROK124027.3****                                 7

 - SAMPLE DATA TOTAL ---------------      1  - SAMPLE HEADER TOTAL -------------      1  - SAMPLE TOTAL ---------------------      2
 -- CARD CLASS TOTALS FOR SAMPLE ---
  HEAD      1      WROK      1


CONTRACTOR: WEST VIRGINIA          FILE: LITHOLOGY     LAB: MARY BENLING          WELL NMBR: 4704321637000O   SAMPLE NMBR: 124029.0
                          WROK124029.0****                                 7

 - SAMPLE DATA TOTAL ---------------      1  - SAMPLE HEADER TOTAL -------------      1  - SAMPLE TOTAL ---------------------      2
 -- CARD CLASS TOTALS FOR SAMPLE ---
  HEAD      1      WROK      1


CONTRACTOR: WEST VIRGINIA          FILE: LITHOLOGY     LAB: MARY BENLING          WELL NMBR: 4704321637000O   SAMPLE NMBR: 124030.8
                          WROK124030.8****                                 8
 - SAMPLE DATA TOTAL ---------------      1  - SAMPLE HEADER TOTAL -------------      1  - SAMPLE TOTAL ---------------------      2
 -- CARD CLASS TOTALS FOR SAMPLE ---
  HEAD      1      WROK      1

 - WELL DATA TOTAL -----------------    212  - WELL HEADER TOTAL ---------------    212  - WELL TOTAL -----------------------    424
 -- CARD CLASS TOTAL FOR WELL ------
  HEAD    212      WROK    212


 -- LAB DATA TOTAL -----------------    379  -+ LAB HEADER TOTAL ---------------    379  -- LAB TOTAL -----------------------    758
 --- FILE DATA TOTAL ---------------    379  --- FILE HEADER TOTAL -------------    379  --- FILE TOTAL --------------------    758
 ---- CONTRACTOR DATA TOTAL --------  6,185  ---- CONTRACTOR HEADER TOTAL ------  1,138  ---- CONTRACTOR TOTAL -------------  7,323
```

FIGURE 4. TSPH07 Sample Printout 2.

totals by well and sample number, header and data record totals by laboratory, and sample file categories for each EGSP contractor are printed throughout the report (fig. 5) (Hessel and others, 1981).

An important part of the EGSP sample-data file is an analytical-methods file. The methods file contains alphanumeric codes for analytical methods used with each card class for each contractor. More than 100 method codes and appropriate method-code descriptions were recorded, keypunched, read to tape, and delivered to METC for storage and retrieval. Method descriptions vary in complexity and are contractor-dependent. References to published reports are included for most description to provide additional information.

Special data-entry codes were developed for rock mineralogy (card classes MIN1-MIN6), X-ray diffraction analysis (card classes XRA1-XRA3 and LTTM), and elemental analysis (card classes ELM1-ELM9). These special codes and interpretations are in Appendix C. Additional special codes for such items as lithology, grain roundness, bedding thickness, type of grading, lamination, bedding-plane markings, fossil constituents, and fracture planarity have been available for data encoding (Dyman and Wilcox, 1979, Appendix A).

Appendix D lists all wells and outcrops for each state and county, and lists all card classes and total records for each. At present, EGSP wells are found in 95 counties throughout the basin. For all wells together, 83 of 144 total card classes contain data.

P E T R O L E U M I N F O R M A T I O N
METHOD CODES BY CONTRACTOR

```
          1         2         3         4         5         6         7         8
12345678901234567890123456789012345678901234567890123456789012345678901234567890

CONTRACTOR: ALFRED UNIVERSITY          FILE: CHEM                LAB: BYRON KULANDER
     MIN5AU2                                                        XD        X       XD
     MIN5AU2                                                        XD
     MIN5AU3                                                        XD
     MIN5AU3                                                        XD        X       XD
     MIN5AU3          XD          XD       XD       XD       XD  5.5XD       XD      XD
     MIN5AU7                                                        XD        X      TXD
     MIN5AU6                                                        XD        X       XD
     MIN5AU8          XD          TXD      XD       XD       XD  4.9XD       XD      XD
     MIN5AU7                                                        XD

     SON15AU36    4.830 3.047 4.797 3.021 4.848 3.027 4.852 3.026 4.835 3.022 4.837**
     SON15AU36    4.830 3.047 4.797 3.021 4.848 3.027 4.852 3.026 4.835 3.022 4.837**
     SON13AU35    2.978KS                                                          **
     SON13AU35    4.703 2.939 4.767 2.985 4.728 2.975 4.794 3.013 4.741 2.941 4.766**
     SON13AU35    4.703 2.939 4.767 2.985 4.728 2.975 4.794 3.013 4.741 2.941 4.766**
     YUNG3AU35    .053.054.054.055.053.054                                         ***
     YUNG5AU36    .056.055.056.056.055.056                                         ***
     YUNG6AU37    .072.071.067.072.073.072                                         ***
     YUNG11AU40   .067.067.068.069.068.068                                         ***
     YUNG7AU38    .053.053.053.053.053.053                                         ***
     YUNG22AU44   .051.050.050.051.051.051                                         ***
     YUNG9AU39    .050.049.048.050.051.050                                         ***
     YUNG20AU43   .073.073.073.073.073.073                                         ***
```

```
-- LAB DATA TOTAL ----------------    239  -- LAB HEADER TOTAL ---------------    202  -- LAB TOTAL ----------------------    441
--- FILE DATA TOTAL ---------------    239  --- FILE HEADER TOTAL -------------    202  --- FILE TOTAL ---------------------    441
---- CONTRACTOR DATA TOTAL ---------    792  ---- CONTRACTOR HEADER TOTAL ------    244  ---- CONTRACTOR TOTAL -------------  1,036
```

FIGURE 5. TSPHO7 Sample Printout 2.

DATA MANAGEMENT

System 2000 was procured by METC to support the management of data for use by scientific and technical personnel. The software is presently stored at MITRE Corporation in McLean, Virginia, and METC has established telecommunication lines for interactive terminal access. Output options include a host of statistical analyses, graphics and mapping output, and a variety of data-retrieval capabilities.

The EGSP files are also maintained as separate searchable files at PI in Denver. The EGSP well-data file is maintained on PI's IBM-370 158 (MVS system) using the Petroleum Information Retrieval System (PIRS). Data is stored on magnetic tape in a format such that PIRS can retrieve by location, well name, presence or absence of data items, or by almost any other parameter if recorded. The EGSP sample data file is stored and maintained on PI's PRIME 400 using a data file management system called TECH/SYS. TECH/SYS can be used to modify, reorganize and retrieve a wide variety of geoscience data. Output from PIRS and TECH/SYS may include:

1. contoured maps and plots of wells,
2. trend surface, structure, and isopach maps,
3. a wide variety of digital printouts of well, outcrop and sample data,
4. cross-sections, lithology plots and log curve displays of well- and sample-file data, and
5. statistical summaries including histograms and frequency plots, and cross plots.

SUMMARY

When looking at the EGSP data-gathering task in retrospect, modifications to project management would have made the data-gathering process more successful.

Many problems resulted from having contractors perform their own data encoding. Some EGSP contractors had little knowledge of computer- and data-encoding techniques, and they often delegated encoding responsibilities to subordinates who were not properly informed about procedures. Other contracters completed project requirements to DOE before final formats were approved. Some of these data were omitted or improperly encoded. In some instances, communication problems resulted from contractor's personnel changes. Workers not familiar with WHCS file structure found the well-data encoding forms (fig. 1) difficult to understand. Many encoding errors resulted when contractor staff completed this work. Three data-reformat programs were written by PI to convert data in contractor formats to EGSP formats. These programs would have been unnecessary if the data-encoding process had been strictly adhered to.

The overall lack of uniformity in analytical procedures and methods resulted in an apparent over-abundance of card classes. Nearly 40 percent of the available card classes were never used, and about 30 percent of those used contain fewer than 100 data records. Part of this problem stems from the fact that although format design was finalized relatively early in the project and every potentially important data category was included, significant changes in overall project direction during the course of the EGS study reduced the number of important data items.

Another serious problem became apparent when reviewing the distribution of data by well in Appendix D. For some wells, most card classes are represented, but for others only few are represented. Long delays exist in acquiring some well and sample data, and considerable effort must be made before completion of the project to input the missing information. During the next year, a special task will be conducted to input 1) cored well stimulation and production data into the well-data file, and (2) lithologic descriptions from cores and outcrops into both the EGSP well-data and sample-data files. In addition, all EGSP published reports will be reviewed to determine what additional information has missed capture.

The relationship between data and header records has been confusing to contractor encoders. Sample numbers must be unique for each contractor and must be placed in different character positions on data and header records. Contractor's bookkeeping of sample numbers was often made difficult by personnel changes and the 4 years spent in amassing the data. With centralized encoding, a sequence number and laboratory code would have been adequate to identify data records.

The most serious problem encountered during data-file development has been the long delay in arranging for an efficient retrieval and mapping system. Whether a complex data-base system is used to store and retrieve data, or a retrieval program simply accesses data for output, data management must be addressed at the same time that initial formats are designed. Sample- and well-data file management are now coordinated through METC, and Petroleum Information Corporation maintains an effective in-house data management system for data retrieval and analysis. The present system would have been very useful to retrieve data for contractor needs two years earlier, even though the files were incomplete.

Both the EGSP well- and sample data files will be most useful when additional data are added to each file, and continuous access to these data can assist in the overall EGSP research effort.

References Cited

American Petroleum Institute, 1970, The API well number and standard State and County codes: American Petroleum Institute Bulletin D12A, 82 p.

Dyman, T. S., and Wilcox, L. A., 1979, Data encoding formats for well and outcrop samples; Eastern gas shales project: U. S. Geological Survey Open-File Report 79-1690, 124 p.

Hessel, P. J., Dyman, T. S., and Wilcox, L. A., 1980, TSPH06 and TSPH07; structured Cobal programs to retrieve, edit, and list EGSP sample data by contractor, laboratory, sample-file type, well, and sample number: U.S. Geological Survey Open-File Report 81-242, 53 p.

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APPENDIX A

EGSP Well Totals by County

Appendix A

EGSP Well Totals by County and by State

State	County	Wells	Outcrops	Total
Kentucky	Adair	28	0	28
	Allen	95	0	95
	Anderson	1	0	1
	Ballard	1	0	1
	Barren	40	1	41
	Bath	4	0	4
	Bell	4	0	4
	Boone	3	0	3
	Bourbon	23	3	26
	Boyd	23	3	26
	Boyle	4	0	4
	Bracken	1	0	1
	Breathitt	31	0	31
	Breckinridge	32	0	32
	Bullitt	15	0	15
	Butler	19	0	19
	Caldwell	36	0	36
	Calloway	1	0	1
	Carlisle	4	0	4
	Carter	15	0	15
	Casey	40	0	40
	Christian	158	0	158
	Clark	5	0	5
	Clay	154	0	154
	Clinton	76	0	76
	Crittenden	9	0	9
	Cumberland	88	0	88
	Daviess	155	0	155
	Edmonson	16	0	16
	Elliott	16	0	16
	Estill	17	0	17
	Fayette	2	0	2
	Fleming	5	4	9
	Floyd	57	0	57
	Franklin	2	0	2
	Fulton	1	0	1
	Gallatin	6	0	6
	Garrard	4	0	4
	Grant	3	0	3
	Grayson	16	0	16

State	County	Wells	Outcrops	Total
Kentucky	Green	5	0	5
	Greenup	1	2	3
	Hancock	6	0	6
	Hardin	11	0	11
	Harrison	2	0	2
	Hart	11	0	11
	Henderson	82	0	82
	Henry	4	0	4
	Hopkins	182	0	182
	Jackson	2	0	2
	Jefferson	5	0	5
	Jessmine	3	0	3
	Johnson	72	0	72
	Kenton	2	0	2
	Knott	60	0	60
	Knox	11	0	11
	Larue	4	0	4
	Laurel	41	0	41
	Lawrence	77	0	77
	Lee	3	0	3
	Leslie	2	0	2
	Lewis	7	4	11
	Lincoln	10	0	10
	Logan	24	0	24
	McCracken	2	0	2
	McCreary	23	0	23
	McLean	156	0	156
	Madison	8	0	8
	Magoffin	9	0	9
	Marion	10	0	10
	Marshall	1	0	1
	Martin	23	0	23
	Mason	2	0	2
	Meade	22	0	22
	Menifee	4	0	
	Mercer	1	0	1
	Metcalfe	18	0	18
	Monroe	19	0	19
	Montgomery	9	0	9
	Morgan	30	0	30
	Muhlenberg	163	0	163
	Nickolas	2	0	2
	Ohio	169	0	169
	Oldham	5	0	5
	Owen	5	0	5
	Owsley	3	0	3

State	County	Wells	Outcrops	Total
Kentucky	Pendleton	3	0	3
	Perry	115	0	115
	Pike	106	0	106
	Powell	22	0	22
	Pulaski	12	0	12
	Rowan	0	1	1
	Russell	32	0	32
	Scott	5	0	5
	Shelby	9	0	9
	Simpson	9	0	9
	Spencer	7	0	7
	Taylor	11	0	11
	Todd	52	0	52
	Trigg	4	0	4
	Union	60	0	60
	Warren	40	0	40
	Washington	3	0	3
	Wayne	16	0	16
	Webster	115	0	115
	Whitley	15	0	15
	Wolfe	4	0	4
	Woodford	3	0	3

State	County	Wells	Outcrops	Total
New York	Albany	0	1	1
	Allegany	140	0	140
	Broome	5	0	5
	Cattaraugus	76	0	76
	Cayuga	7	0	7
	Chautauqua	169	1	170
	Chemung	34	0	34
	Chenango	9	0	9
	Cortland	3	0	3
	Delaware	7	0	7
	Erie	91	0	91
	Genesee	18	0	18
	Greene	1	1	2
	Livingston	52	0	52
	Madison	10	0	10
	Oneida	2	0	2
	Onondaga	7	1	8
	Ontario	80	0	80
	Otsego	7	0	7
	Schoharie	1	0	1
	Schuyler	23	0	23
	Seneca	5	0	5
	Steuben	231	1	232
	Sullivan	1	0	1
	Tioga	3	0	3
	Tompkins	12	0	12
	Ulster	2	0	2
	Wyoming	54	0	54
	Yates	12	0	12

State	County	Wells	Outcrops	Total
Ohio	Ashland	1	3	4
	Ashtabula	26	0	26
	Athens	10	1	11
	Belmont	3	0	3
	Carroll	11	0	11
	Columbiana	17	0	17
	Coshocton	17	3	20
	Cuyahoga	0	2	2
	Delaware	12	3	15
	Erie	3	0	3
	Fairfield	11	2	13
	Franklin	0	1	1
	Gallia	5	0	5
	Geauga	9	3	12
	Guernsey	17	0	17
	Harrison	10	1	11
	Hocking	3	1	4
	Holmes	10	3	13
	Huron	15	0	15
	Jackson	3	0	3
	Jefferson	2	0	2
	Knox	8	1	9
	Lake	2	1	3
	Lawrence	5	0	5
	Licking	15	1	16
	Lorain	9	0	9
	Mahoning	14	0	14
	Marion	1	0	1
	Medina	3	0	3
	Meigs	9	1	10
	Monroe	3	0	3
	Morgan	14	0	14
	Morrow	16	0	16
	Muskingum	23	2	25
	Noble	15	0	15
	Perry	15	1	16
	Pickaway	4	0	4
	Pike	8	0	8
	Portage	24	0	24
	Richland	21	1	22
	Ross	8	1	9
	Stark	21	0	21
	Summit	1	0	1
	Trumbull	25	3	28
	Tuscarawas	27	6	33
	Vinton	6	0	6
	Washington	14	0	14
	Wayne	7	0	7

State	County	Wells	Outcrops	Total
Pennsylvania	Armstrong	8	0	8
	Beaver	10	0	10
	Bedford	1	4	5
	Blair	4	4	5
	Bradford	6	0	6
	Butler	1	0	1
	Cambria	9	0	9
	Cameron	8	0	8
	Centre	2	2	4
	Clarion	7	1	8
	Clearfield	19	0	19
	Clinton	7	0	7
	Columbia	0	2	2
	Crawford	73	1	74
	Elk	8	0	8
	Erie	79	2	81
	Fayette	13	0	13
	Forest	4	2	6
	Fulton	0	1	1
	Greene	1	0	1
	Huntingdon	0	5	0
	Indiana	15	0	15
	Jefferson	5	0	5
	Juniata	0	2	0
	Lawrence	2	2	4
	Lycoming	5	1	6
	McKean	21	0	21
	Mercer	19	0	19
	Mifflin	0	2	2
	Monroe	0	4	4
	Northumberland	0	2	2
	Perry	0	6	6
	Potter	17	0	17
	Snyder	0	2	2
	Somerset	18	0	18
	Sullivan	2	0	2
	Susquehanna	1	0	1
	Tioga	15	0	15
	Union	0	3	3
	Venango	11	1	12
	Warren	13	3	16
	Washington	4	0	4
	Westmoreland	20	0	20

State	County	Wells	Outcrops	Total
Tennessee	Grainger	0	1	1
	Humphreys	0	1	1
	Maury	0	1	1
	Perry	0	1	1
	Scott	1	0	1

State	County	Wells	Outcrop	Total
West Virginia	Braxton	1	0	1
	Cabell	174	0	174
	Calhoun	7	0	7
	Doddridge	0	1	1
	Grant	0	1	1
	Greenbrier	2	0	2
	Hampshire	0	2	2
	Jackson	107	0	107
	Lincoln	76	0	76
	McDowell	1	0	1
	Mason	13	0	13
	Mercer	1	0	1
	Mingo	14	0	14
	Pendleton	0	1	1
	Pleasants	11	0	11
	Putnam	79	0	79
	Raleigh	4	0	4
	Ritchie	5	0	5
	Roane	8	0	8
	Summers	2	0	2
	Wayne	1	0	1
	Wirt	1	0	1
	Wood	1	0	1
	Wyoming	1	0	1

APPENDIX B

EGSP Sample data File-Card Class Data Summary

GEOCHEMICAL FILE CONTENT

Card	Card Class	Description
1	CHEM	Header Information
2 - 3	ROR1-2 HER1-2	C1 - C7 Blended Gas - Rock, or Headspace Gas
4 - 7	GRR1-4 GRO1-4	C4 - C7 Gasoline Range of Rock or Oil
8 - 11	TEB1-4 TEC1-4 TED1-4 TEE1-4 TEF1-4 TEG1-4	C7 - C30 Thermal Extraction and Gas Chromatography of Rock or Oil
12	PYR1	C1 - C32 Pyrolysis of Rock - Gas Chromatography of Products Evolved
13	TEA1	Thermal Evolution Analysis (TEA) - Flame Ionization Detector (FID) of Rock
14	BIT1	C15 + Bitumen by Solvent Extraction of Rock
15	HNR1	C15 + Hydrocarbon and Non-Hydrocarbon Fractions (Rock or Oil)
16 - 17	SHA1-2 SHB1-2 SHC1-2 SHD1-2	C15 + Saturated Hydrocarbons - Gas Chronatography of Rock or Oil
18 - 19	VIT1-9	Vitrinite Reflectance of Rock
20	TAI1	Visual Kerogen and Thermal Alteration Index (TAI)
21 - 25	MIN1-5	Mineralogy of Rock
26 - 34	ELM1-ELM9	Elemental Analysis of Rock
35	KER1	Elemental Analysis of Kerogen of Rock

GEOCHEMICAL FILE CONTENT

Card	Card Class	Description
36	ASP1	Delta 34S, Delta 15N, Percent Nitrogen of C15 + Asphaltic Fraction
37	HYD1	Delta 13C of C15 + Hydrocarbon Fractions of Rock
38	HED1	Delta 13C of CH4 in Headspace Gas
39	API1	API Gravity of Oil
40	HNH1	C15 + Hydrocarbon and Non-Hydrocarbon Fractions of Oil
41	WHL1	Delta 13C of Whole Oil
42	FRA1	Delta 13C of C15 + Hydrocarbon Fractions of Oil
43	DEL1	Delta 34S, Delta 15N, Percent Nitrogen of Whole Oil
44 - 45	COM1-2	C1 - C7 Component Analysis of Gas
46	CGA1	Delta 13C of CH4 and CO2 of Gas
47 - 48	WAT1-2	Major Ions of Water
49	LTA1	Delta 13C of CO2 of Gas
50	ELT1	Delta 34S of SO4 of Water
51	DIF1	Gaseous Diffusion Analysis
52	OFF1	Offgas Analysis
53	GSRA	Gas/Shale Ratio

PHYSICAL CHARACTERIZATION FILE CONTENT

Card	Card Class	Description
1	PHED	Header Information
2	PDEN	Density, Specific Gravity, Permeability, Hardness, Pore Size Distribution
3	PLOD	Point Load Fracture
4	DITS	Directional Tensile Strength
5 - 6	SON1-2	Directional Sonic Velocity
7	YUNG	Directional Dynamic Elastic Constants (Young's Modulus)
8	SHER	Directional Dynamic Elastic Constants (Average Shear Modulus)
9	PISN	Directional Dynamic Elastic Constants (Average Poisson's Ratio)
10	COMP	Directional Compressive Strength
11 - 12	LOG1-2	Log Data (General)
13	GRAV	Borehole Gravity
14	GAMM	Gamma Ray Intensity and Formation Density Evaluation
15	PCHR	Physical Characterization Data

LITHOLOGY FILE CONTENT

Card	Card Class	Description
1	HEAD	Header Information
2	LITH	Lithology
3	WROK	Whole Rock Mineral Analysis and Size Analysis
4 - 6	XRA1-3	X-Ray Diffraction
7	LTTM	X-Ray Diffraction - Less than Two Micron Clay Analysis
8	QRTZ	Quartz Grain Size Analysis
9	PHYS	Physical Measurements
10	SED1	Sedimentary Features
11	PALO	Paleontology
12 - 13	FRAC FRC1	Fracture Data
14	INTR INMC	Fracture Data and Intersected Lithologies

APPENDIX C

Sample-Data File Special Code Summary

APPENDIX C

Sample-Data File Special Code Summary

1. Card types affected: MIN1 through MIN6 (Note MIN6 will be defined later as an update to the official data encoding formats), XRA1, XRA2, XRA3, and LTTM. These fields are defined to 5 positions in length and are defined in FORTRAN programming code as F 5.2.

ENTRY	INTERPRETATION
-9999	Major trace or trace (if major not defined)
-9998	Minor trace
-9997	Value below detection limits
-9996	Value undetermined
Blank	Not tested
86400	Less than 64 percent
83939	Less than 39.39 percent
76400	Less than 64 ppm
73601	Less than 36.01 ppm
66400	Greater than 64 percent
64605	Greater than 46.05 percent
56400	Greater than 64 ppm
58702	Greater than 87.02 ppm
.014 (right justified)	.014 percent (decimal input overrides)
.0001	.0001 percent
.1 (right justified)	.1 percent

ENTRY	INTERPRETATION
001 (right justified)	.01 percent (decimal point is assumed)
98877	88.77 percent (leading 9 indicates % input)
8877	88.77 ppm

For FORTRAN programming purposes assume that any value less than 1 or greater than 90000 is a percent unput after reading data in an F 5.2 format.

Remember 10000 ppm = 1 percent

2. Card types affected ELM1 through ELM9. These fields are defined to be 6 positions in length and are defined in FORTRAN programming code as F 6.2.

ENTRY	INTERPRETATION
001	0.01 ppm
666666	6666.66 ppm
995555	55.55 percent
990001	0.01 percent
.014	.014 ppm (decimal input overrides)
-99999	Major trace or trace (if major is not defined)
-99998	Minor trace
-99997	Value undetermined
Blank	Not tested
86400	Less than 64 percent
83939	Less than 39.39 percent
76400	Less than 64 ppm
73601	Less than 36.01 ppm

ENTRY	INTERPRETATION
66400	Greater than 64 percent
64605	Greater than 46.05 percent
56400	Greater than 64 ppm
58702	Greater than 87.02 ppm

3. Mound data input in the card classes mentioned in number 2 above are as follows:

ENTRY	INTERPRETATION
-9.0	Major trace or trace (if major is not defined)
-8.0	Minor trace
-7.0	Value undertermined

APPENDIX D

EGSP Wells For Which Sample Data are Available

APPENDIX D

EGSP Sample Data File Summary By Well

State	County	Well	Card	Class	Totals *	
Kentucky	Bullitt	92001	CHEM	27	ELM5	27
			ELM1	27	ELM6	26
			ELM2	27	ELM7	28
			ELM3	27	ELM8	27
			ELM4	27	ELM9	27
	Casey	92001	CHEM	9	ELM5	9
			ELM1	9	ELM6	9
			ELM2	9	ELM7	9
			ELM3	9	ELM8	9
			ELM4	9	ELM9	9
	Christian	31175	API1	33	GRR1	33
			ASP1	33	GRR2	33
			BIT1	33	GRR3	33
			CHEM	59	GRR4	33
			COM1	33	HER1	33
			COM2	33	HER2	33
			ELM1	16	HNR1	33
			ELM2	45	LER1	36
			ELM3	16	ROR1	33
			ELM4	28	ROR2	33
			ELM5	16	SHB1	33
			ELM6	16	SHB2	33
			ELM7	16	TAI1	33
			ELM8	26	TEA1	33
			ELM9	16	VIT1	33
			HYD1	12		
	Cumberland	92001	CHEM	7	ELM5	7
			ELM1	7	ELM6	7
			ELM2	7	ELM7	7
			ELM3	7	ELM8	7
			ELM4	7	ELM9	7
	Estill	92001	CHEM	12	ELM5	12
			ELM1	12	ELM6	12
			ELM2	12	ELM7	12
			ELM3	12	ELM8	12
			ELM4	12	ELM9	12
	Fleming	92001	CHEM	21	ELM5	21
			ELM1	21	ELM6	21
			ELM2	21	ELM7	21
			ELM3	21	ELM8	21
			ELM4	21	ELM9	21

State	County	Well	Card	Class	Totals	
	Greenup	90001	HEAD	30	LITH	29
	Letcher	06001	CHEM	19	ELM5	16
			HYD1	14	ELM8	4
			ELM2	19		
			ELM4	16		
	Lewis	92001	CHEM	15	ELM5	15
			ELM1	15	ELM6	15
			ELM2	15	ELM7	15
			ELM3	15	ELM8	15
			ELM4	15	ELM9	15
	Madison	92002	CHEM	13	ELM5	13
			ELM1	13	ELM6	13
			ELM2	13	ELM7	13
			ELM3	13	ELM8	13
			ELM4	13	ELM9	13
	Martin	31020	CHEM	77	GRR3	4
			DIF1	63	GRR4	4
			DITS	337	HEAD	779
			ELM1	26	HED1	18
			ELM2	62	HER1	17
			ELM3	26	HYD1	13
			ELM4	43	RER1	5
			ELM5	44	LITH	232
			ELM6	26	LTTM	67
			ELM7	26	MIN1	25
			ELM8	26	MIN2	49
			ELM9	29	MIN4	25
			GRR1	4	MIN5	75
			GRR2	4	PALO	91
			PDEN	669	VIT1	5
			PHED	1040	VOT2	5
			PLOD	43	VIT3	5
			SHER	10	XRA1	67
			SON1	51	XRA2	67
			TAI1	5	XRA3	67
			TEA1	18	YUNG	10
	Perry	28982	HEAD	216	ELM4	92
			LITH	214	ELM5	92
			LTTM	34	ELM6	69
			XRA1	34	ELM7	69
			XRA2	113	ELM8	79
			XRA3	34	MIN1	69
			CHEM	113	MIN1	69
			ELM1	69	MIN2	69
			ELM2	113	MIN4	69
			ELM3	69	PYR1	69

State	County	Well	Card	Class	Totals	
	Perry	28982	FRAC	2067	HED1	21
			GRR1	4	HYD1	18
			GRR2	4	KER1	5
			GRR3	4	TAI1	5
			GRR4	4	TEA1	21
			VIT1	5		
			VIT2	5		
			VIT3	5		
	Powell	92001	CHEM	33	ELM5	33
			ELM1	33	ELM6	33
			ELM2	33	ELM7	33
			ELM3	33	ELM8	33
	Pulaski	92001	CHEM	12	ELM5	12
			ELM1	12	ELM6	12
			ELM2	12	ELM7	12
			ELM3	12	ELM8	12
			ELM4	20	ELM9	20
	Rowan	92001	CHEM	20	ELM5	20
			ELM1	20	ELM6	20
			ELM2	20	ELM7	20
			ELM3	20	ELM8	20
			ELM4	20	ELM9	20
	Russell	92001	CHEM	8	ELM5	8
			ELM1	8	ELM6	8
			ELM2	8	ELM7	8
			ELM3	8	ELM8	8
			ELM4	8	ELM9	8

State	County	Well	Card	Class	Totals	
New York	Alleghany	04010	CHEM	33	COM2	33
			COM1	33	HED1	33
	Alleghany	04248	CHEM	2	ELM5	2
			ELM1	2	ELM6	2
			ELM2	2	ELM7	2
			ELM3	2	ELM8	2
			ELM4	2	ELM9	2
	Allegheny	13549	CHEM	22	DIF1	66
	Cattaraugus	04153	CHEM	3	ELM5	3
			ELM1	3	ELM6	3
			ELM2	3	ELM7	3
			ELM3	3	ELM8	3
			ELM4	3	ELM9	3
	Cattaraugus	06740	CHEM	15	ELM5	2
			ELM1	2	ELM6	2
			ELM2	16	ELM7	2
			ELM3	2	ELM8	2
			ELM4	2	ELM9	2
					HYD1	
	Cattaraugus	09740	CHEM	1	ELM5	1
			ELM1	1	ELM6	1
			ELM2	1	ELM7	1
			ELM3	1	ELM8	1
			ELM4	1	ELM9	1
	Chautauqua	02672	CHEM	3	ELM5	3
			ELM1	3	ELM6	3
			ELM2	3	ELM7	3
			ELM3	3	ELM8	3
			ELM4	3	ELM9	3
	Steuben	10334	CHEM	1	ELM5	1
			ELM1	1	ELM6	1
			ELM2	1	ELM7	1
			ELM3	1	ELM8	1
			ELM4	1	ELM9	1
	Wyoming	04546	CHEM	4	ELM5	4
			ELM1	5	ELM6	4
			ELM2	4	ELM7	4
			ELM3	4	ELM8	4
			ELM4	4	ELM9	4

State	County	Well	Card	Class	Totals	
Ohio	Carroll	20835	CHEM	66	ELM7	56
			ELM1	56	ELM8	56
			ELM2	66	ELM9	56
			ELM3	56	MIN1	41
			ELM4	56	MIN2	41
			ELM5	56	MIN4	41
			ELM6	56	PRY1	41
			HEAD	279	HYD1	2
			LITH	279	PHYS	15
			LTTM	25	SEDI	14
			PALO	104	WROK	15
			PCHR	15	XRA1	25
			PHED	15	XRA2	25
					XRA3	25
	Coshocton	90001	FRAC	19	LITH	19
			FRC1	19	SED1	19
			HEAD	19		
	Coshocton	90002	FRAC	3	LITH	3
			FRC1	3	SED1	3
	Coshocton	90003	FRAC	19	LITH	19
			FRC1	19	SED1	19
			HEAD	19		
	Cuyahoga	90001	FRAC	52	LITH	52
			HEAD	52		
	Cuyahoga	90002	FRAC	31	LITH	31
			FRC1	31	SED1	31
			HEAD	31		
	Ashland	90001	FRAC	33	LITH	33
			FRC1	33	SED1	33
	Ashland	90002	FRAC	13	LITH	33
			FRAC1	12	SED1	13
			HEAD	13		
	Ashland	90003	FRAC	14	LITH	14
			FRC1	14	SED1	14
			HEAD	14		
	Athens	90001	FRAC	28	LITH	28
			FRC1	28	SED1	28
			HEAD	28		
	Delaware	90003	FRAC	61	LITH	61
			FRC1	61	SED1	61

State	County	Well	Card	Class	Totals	
Ohio	Delaware	90003	HEAD	61		
	Delaware	90004	FRAC	61	LITH	61
			FRC1	61	SED1	61
			HEAD	61		
	Delaware	90005	FRAC	72	LITH	61
			FRC1	72	SED1	61
			HEAD	72		
	Erie	20057	CHEM	12	ELM9	12
			ELM1	12	HEAD	12
			ELM2	12	LITH	12
			ELM3	12	PALO	12
			ELM4	12	PHYS	8
			ELM5	12	SED1	12
			ELM6	12	XRA1	12
			ELM7	12	XRA2	12
			ELM8	12	XRA3	7
	Fairfield	90001	FRAC	40	LITH	40
			FRC1	40	SED1	40
			HEAD	40		
	Geauga	90001	FRAC	25	LITH	25
			FRC1	25	SED1	25
			HEAD	25		
	Geauga	90002	FRAC	28	LITH	28
			FRC1	28	SED1	28
			HEAD	28		
	Geauga	90003	FRAC	32	LITH	32
			FRC1	33	SED1	32
			HEAD	32		
	Harrison	90001	FRAC	23	LITH	23
			FRC1	23	SED1	23
			HEAD	23		
	Hocking	90001	FRAC	6	LITH	6
			FRC1	6	SED1	6
			HEAD	6		
	Holmes	90001	FRAC	32	LITH	32
			FRC1	31	SED1	32
			HEAD	32		
	Holmes	90002	FRAC	26	LITH	26
			FRC1	26	SED1	26
			HEAD	26		

State	County	Well	Card	Class	Totals	
Ohio	Holmes	90003	FRAC	18	LITH	18
			FRC1	18	SED1	18
			HEAD	18		
	Knox	90001	FRAC	23	LITH	23
			FRC1	23	SED1	23
			HEAD	23		
	Licking	90001	FRAC	30	LITH	30
			FRC1	30	SED1	30
			HEAD	30		
	Lorain	06002	CHEM	58	HEAD	62
			ELM1	58	LITH	62
			ELM2	58	PALO	61
			ELM3	58	PHYS	31
			ELM4	58	SED1	61
			ELM5	58	WROK	59
			ELM6	58	XRA1	58
			ELM7	58	XRA2	58
			ELM8	58	XRA3	58
	Meigs	90001	FRAC	6	LITH	6
			FRC1	6	SED1	6
			HEAD	6		
	Muskingum	90001	FRAC	4	LITH	4
			FRC1	4	SED1	4
			HEAD	4		
	Muskingum	90002	FRAC	30	LITH	30
			FRC1	30	SED1	30
			HEAD	30		
	Perry	no #	FRAC	3	LITH	3
			FRC1	3	SED1	3
			HEAD	3		
	Richland	90001	FRAC	28	LITH	28
			FRC1	28	SED1	28
			HEAD	28		
	Ross	01002	CHEM	37	ELM5	37
			ELM1	37	ELM6	37
			ELM2	37	ELM7	37
			ELM3	37	ELM8	37
			ELM4	37	ELM9	37
			HEAD	37	PHED	25
			LITH	37	PHYS	6
			PALO	37	SED1	12
			PCHR	25	WROK	12

State	County	Well	Card	Class	Totals	
Ohio	Ross	90001	FRAC	59	LITH	59
			FRC1	59	SED1	59
			HEAD	59		
	Stark	90006	FRAC	2	LITH	2
			FRC1	2	SED1	2
			HEAD	2		
	Trumbull	90001	FRAC	31	LITH	31
			FRC1	31	SED1	31
			HEAD	31		
	Summit	06001	CHEM	84	HEAD	102
			ELM1	84	LITH	92
			ELM2	84	PALO	92
			ELM4	84	PHED	102
			ELM5	84	PHED	102
			ELM6	84	PHYS	92
			ELM7	84	SED1	92
			ELM8	84	WROK	86
			ELM9	84		
	Trumbull	90002	FRAC	31	LITH	31
			FRC1	31	SED1	31
			HEAD	31		
	Trumbull	90003	FRAC	13	LITH	13
			FRC1	13	SED1	13
			HEAD	13		
	Tuscarawas	90001	FRAC	30	LITH	30
			FRC1	13	SED1	13
			HEAD	30		
	Tuscarawas	90002	FRAC	3	LITH	3
			FRC1	3	SED1	3
			HEAD	3		
	Tuscarawas	90003	FRAC	19	LITH	19
			FRC1	19	SED1	19
			HEAD	19		
	Tuscarawas	90004	FRAC	24	LITH	24
			FRC1	24	SED1	24
			HEAD	24		
	Tuscarawas	90005	FRAC	25	LITH	25
			FRC1	25	SED1	25
			HEAD	25		

State	County	Well	Card	Class	Totals	
Ohio	Tuscarawas	90006	FRAC	2	LITH	2
			FRC1	2	SED1	1
			HEAD	2		
	Vinton	90003	FRAC	20	LITH	20
			FRC1	20	SED1	20
			HEAD	20		
	Washington	23521	CHEM	59	ELM5	28
			DIF1	25	ELM6	28
			ELM1	29	ELM7	28
			ELM2	34	ELM8	28
			ELM3	28	ELM9	28
			ELM4	28	GSRA	25
Ohio	Tuscarawas	23521	HEAD	228	POD5	25
			KER1	20	POV1	25
			LITH	94	POV2	25
			LOG1	25	POV3	25
			LTTM	25	POV4	25
			OFF1	25	POV5	25
			PCHR	53	POV6	25
			PHED	270	PVP1	25
			POD1	25	PVP2	25
			POD2	25	PVP3	25
			POD3	25	PVP4	25
			POD4	25	PVP	25
			PUP6	26	XRA1	25
			XRA2	25	XRA3	24
			DITS	90	PDEN	217
			FRAC	408	PHYS	6
			HYD1	1	PLOD	75
			PALO	35	SED1	19
			SGN1	9	WROK	21

Pennsylvania	Somerset	20034	HEAD	46	LTTM	46
	Sullivan	00005	HEAD	11	XRA1	11
			LITH	11	XRA2	11
			LTTM	11	XRA3	22

State	County	Well	Card	Class	Totals	
Tennessee	Coffee	01001	HEAD	7	XRA1	7
			LITH	7	XRA2	7
			LTTM	7	XRA3	7
	Cumberland	06001	HEAD	8	XRA1	8
			LITH	8	XRA2	8
			LTTM	8	XRA3	8
	Davidson	01001	HEAD	5	XRA1	5
			LITH	5	XRA2	5
			LTTM	5	XRA3	5
	DeKalb	01001	HEAD	9	XRA1	9
			LITH	9	XRA2	9
			LTTM	9	XRA3	9
	Marion	01001	HEAD	3	XRA1	3
			LITH	3	XRA2	3
			LTTM	3	XRA3	3
	Moore	01001	HEAD	4	XRA1	4
			LITH	4	XRA2	4
			LTTM	4	XRA3	4
	Sumner	06001	HEAD	5	XRA1	5
			LITH	5	XRA2	5
			LTTM	5	XRA3	5

State	County	Well	Card	Class	Totals	
Virginia	Wise	20253	API1	9	COM1	9
			API1	15	COM2	9
			BIT1	15	ELM1	74
			CHEM	135	ELM2	114
			GRR1	20	ELM3	6
			GRR2	20	ELM4	74
			GRR3	20	ELM5	74
			GRR4	20	ELM6	74
			HER1	27	ELM7	74
			HER2	15	ELM8	74
			HNR1	15	ELM9	74
			HYD1	18	KER1	16
			ROR1	15	SHB1	15
			ROR2	15	SHB2	15
			TEA1	15	VIT1	15
			FRAC	512	HEAD	403
			HED1	12	LITH	146
			LOG1	70	LTTM	77
			MIN1	70	MIN2	70
			MIN3	70	MIN4	70
			MIN5	70	PALO	103
			PCHR	70	PDEN	445
			PHED	481	SON1	32
			TAI1	5	TEA1	12
			VIT1	5	WROK	70
			VIT2	5	XRA1	77
			VIT3	5	XRA3	77
	Wise	93001	CHEM	36	HYD1	12
			ELM2	36		

State	County	Well	Card	Class	Totals	
West Virginia	Jackson	21369	CHEM	109	MIN4	109
			ELM1	107	MIN5	51
			ELM2	109	PYR1	58
			ELM3	58	WROK	77
			ELM4	107	XRA1	26
			ELM5	107	XRA2	25
			ELM6	107	XRA3	26
			ELM7	107	HEAD	199
			ELM8	107	LITH	148
			ELM9	107	LOGI	51
			MIN1	109	LTTM	26
			MIN2	109	PCHR	51
			MIN3	51	PDEN	51
					PHED	51
	Jackson	21317	CHEM	5	ELM5	5
			ELM2	5	ELM8	5
			ELM4	5	HYD1	3
	Jackson	21371	CHEM	140	HED1	8
			ELM1	137	VIT1	5
			ELM2	140	VIT2	5
			ELM3	94	VIT3	5
			ELM4	138	WROK	46
			ELM5	138	HEAD	1440
			ELM6	137	LITH	47
			ELM7	137	LTTM	47
			ELM8	138	XRA1	47
			ELM9	137	XRA2	47
			MIN1	141	XRA3	47
			MIN2	141	TAI1	5
			MIN3	47	TEA1	8
			MIN4	141	HYD1	1
			MIN5	47	KER1	4
			PYR1	94	LOG1	46
			GRR1	2	PCHR	46
			GRR2	2	PDEN	46
			GRR3	2	PHED	72
			GRR4	2	SON1	26
			FRAC1713			
	Lincoln	21637	CHEM	267	ELM4	198
			ELM1	198	ELM5	198
			ELM2	267	ELM6	198
			ELM3	47	ELM7	198
			ELM8	198	PYR1	47
			ELM9	198	MIN4	47
			MIN1	259	HYD1	8
			MIN2	259	LITH	53
			MIN3	259	LTTM	53
			XRA1	53	HEAD	265
			XRA2	53	LOG1	212

State	County	Well	Card	Class	Totals	
West Virginia	Lincoln	21637	MIN4	212	LOG2	212
			MIN5	212	PCHR	212
			PDEN	1319	PHED	1318
			WROK	212		
	Jackson	22400	GRAV	26	PHED	26
	Jackson	32800	GRAV	31	PHED	31
	Kanawha	69100	GRAV	47	PHED	47
	Kanawha	70100	GRAV	30	PHED	30
	Lincoln	20403	CHEM	89	DIF1	288
	Lincoln	21636	GRAV	21	PHED	21
			HEAD	60	XRA1	60
			LITH	60	XRA3	60
			LTTM	60		
			CHEM	18	HYD1	6
			DITS	215	KER1	4
			ELM2	18	LITH	111
			ELM4	6	PDEN	590
			ELM5	6	PHED	599
			ELM8	6	PLOD	290
			GRR1	3	TAI1	5
			GRR2	3	TEA1	12
			GRR3	3	VIT1	5
			GRR4	3	VIT2	5
			HEAD	111	VIT3	5
			HEDI	12		
	Mason	20146	API1	16	ELM9	67
			ASP1	68	GRR1	68
			BIT1	68	GRR2	68
			CHEM	86	GRR3	68
			COM1	24	GRR4	68
			COM2	34	HER1	84
			ELM1	67	HER2	68
			ELM2	67	HNR1	68
			ELM3	67	ROR1	68
			ELM4	67	ROR2	68
			ELM5	67	SHB1	68
			ELM6	67	SHB2	68
			ELM7	67	VIT1	68
			ELM8	67		
			HEAD	95	LITH	18
			HED1	16	LTTM	77
					PALO	21

State	County	Well	Card	Class	Totals	
West Virginia	Mason	20166	CHEM	10	DIF1	30
	Monongalia	04010	CHEM	6	HED1	6
					HER1	6
	Monongalia	20370	CHEM	6	DEF1	18
	Wetzel	20645	CHEM	7	DIF1	21